AUTOMATIC ANTENNA TUNER

AT-300

SERVICE MANUAL

KENWOOD

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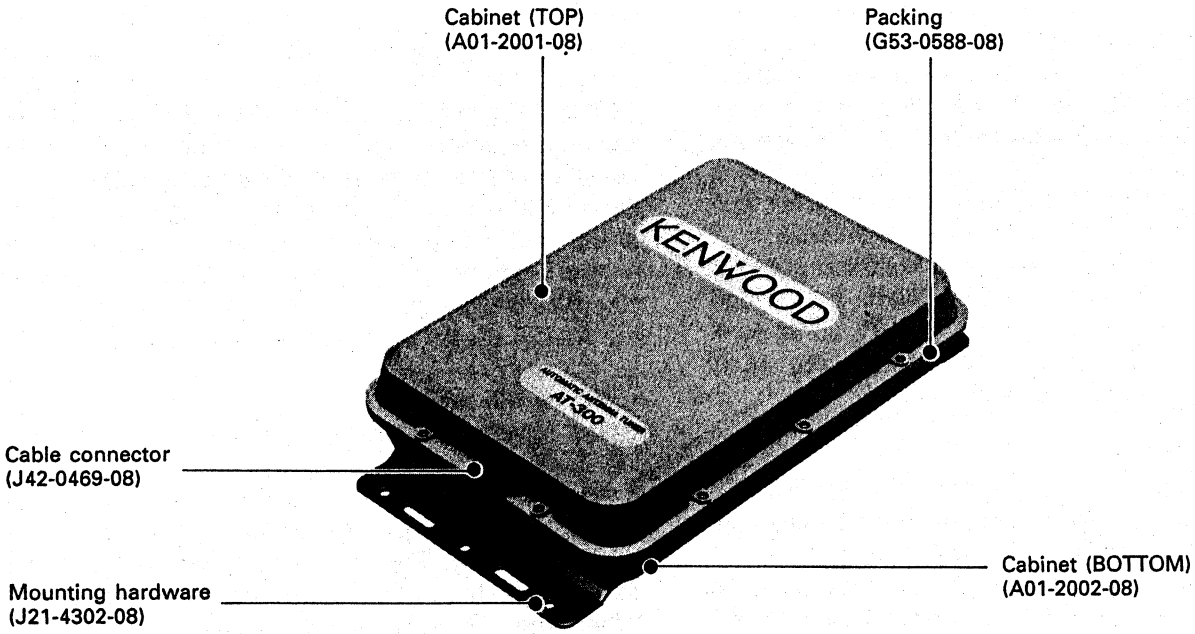
B51-8100-00 (O) 996



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KENWOOD

AAN-0004

Application Note

Amateur Radio Division

Subject: AT-300 Mobile Tuning Notes. **Date:** November 30, 1993

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The AT-300 Automatic Antenna Tuner is capable of tuning a relatively large SWR mismatch when it is used in conjunction with any modern Kenwood Transceiver. The tuner was designed specifically for use in fixed station applications, but some users have indicated a desire to use the tuner in mobile applications. This can cause a number of problems to occur. One such problem might be that the engine of the vehicle would stop when the AT-300 is being used. This is the reason the tuner is not recommended for use in mobile applications! Users who desire to experiment with this type of installation can try the following changes:

Procedure:

1. Remove the cover of the tuner and locate resistors R56 and R57. These are located near IC4.
2. Remove the two resistors.
3. Next locate terminals J5 and J6.
4. Solder a short jumper wire between these two jumpers.

Note: *These changes will improve the matching capabilities of the tuner when used in experimental mobile applications. It is important to note that for product liability reasons Kenwood Americas Corporation, Kenwood Communications Corporation, and Kenwood Service Corporation do not recommend that the user install the tuner in mobile applications under any circumstance.* ***These suggestions are offered for those individuals who wish to experiment with this type of installation at their own risk.***

Time required for this modification is 30 minutes or less.

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CIRCUIT DESCRIPTION

Circuit Description

1. Tuning

The AT-300 is a high-frequency band automatic antenna tuner that can be remotely controlled. When tuning with a remote controlled, the TS terminal of the control cable goes low and a tuning start signal is sent. When the AT-300 detects that the TS terminal is low, the CPU is reset in order to start tuning. A tuning signal is sent from the remote controller to the sensor circuit of the AT-300.

The sensor circuit detects the frequency count, forward voltage, reflected voltage, impedance, and phase voltage and sends the data to the CPU. The CPU then activates a tuning circuit relay to enter the tuning state. When tuning starts, the CPU memorizes the tuning state. When tuning with the same frequency, the current data is used and the tuning state is entered.

When tuning is completed, the TT terminal is set to high to send a termination signal. When the AT-300 detects the termination signal, the STBY signal goes low to return the TS signal to high. The standby mode is then entered to stop the clock.

2. Through mode

The AT-300 can be set in the through mode in which an antenna and the remote controller are directly connected. In this case, the TT terminal of the remote controller foes low. The AT-300 detects that the TT terminal is low. The CPU sets a relay through mode. When mode setting is completed, the CPU enters the standby mode.

3. Tuning test

The AT-300 has a TUNING START switch to test tuning or adjust an antenna. To test tuning, the AT-300 must be connected to a remote controller with the POWER switch ON. When push-button switch S1 of the AT-300 is pressed, tuning starts. Push-button switch S1 sets the TS terminal low and sends a tuning start command to the remote controller. When a tune signal is sent from the remote controller, the AT-300 starts tuning. When tuning is performed normally, the test operation is completed.

4. Interface

Control signals are sent and received between the AT-300 and remote controller using the TS and TT terminals. The TS and TT terminals are bi-directional signal lines.

- **Normal tuning**

When the tuning state is set with a remote controller , the TS signal of the remote controller is set low (usually set to high). When the AT-300 detects that the TS signal is low, the CPU clock is activated to reset the system. At this time, the CPU is activated to check the TS and TT signal status. The CPU sets the TT signal low and reports tuning start. When the TT signal goes low, the remote controller issues a tuning signal. When the AT-300 completes tuning, the TT signal is returned to high indicate completion. The tuning signal from the remote controller stops. The TS signal is set to high to complete the tuning. When the TS signal is set to high, the AT-300 enters the standby mode operation.

- **Abnormal tuning**

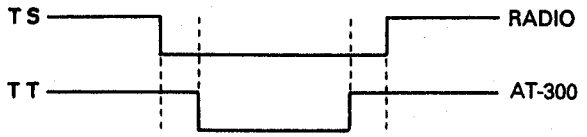
The remote controller counts for 15 seconds after the TS signal is set low and the TT signal is set to high. If the TT signal is not set low before the count is completed, the AT-300 judges that tuning can not be performed normally. The remote controller then sets the TS signal to high and reports a tuning interruption. When the TS signal is set to high, the AT-300's CPU returns the TT signal to high to stop tuning. The AT-300 then enters the standby mode.

- **Through operation**

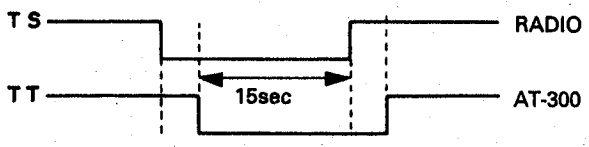
When the TT signal from the remote controller is set low, a through operation is performed. The AT-300 activates the CPU and sets the TS signal low. The remote controller then returns the TT signal to high. When tuning is completed, the AT-300 returns the TS signal to high and sets the CPU in the standby mode to complete the through operation.

CIRCUIT DESCRIPTION

For tuning



For abnormal tuning



For through operation

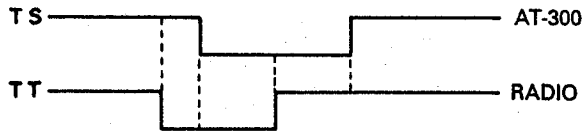


Fig. 1 Interface timing chart

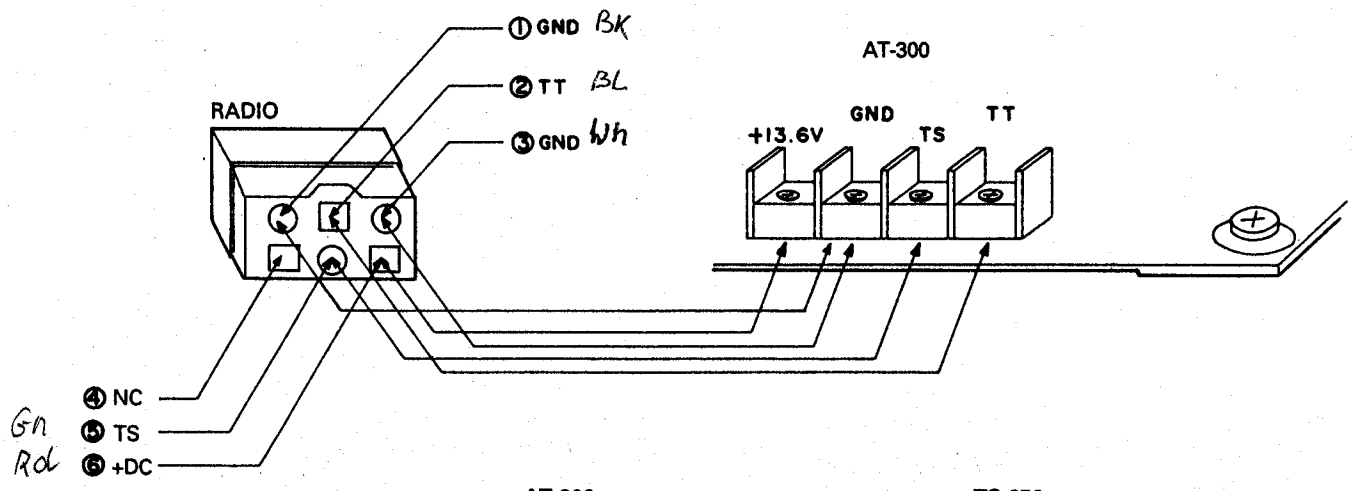
5. Control cable terminals

+13.8V	AT-300's +13.8V DC
GND	Groung
TS	Bidirectional control terminal that controls tuning start and completion via a remote controller and reports through start and completion via the AT-300.
TT	Bidirectional control terminal that controls through start and completion via a remote controller and controls tuning start and completion via the AT-300.

6. Tuning circuit selection

The tuning circuit is used as a PI matching circuit by connecting jumpers J5 and J6. When the tuning circuit is not matched using a PI match, remove the PI circuit and use an π-type matching circuit. The PI circuit is normally not used.

CIRCUIT DESCRIPTION



AT-300

Pin name	Description
+13.6V	13.6V DC input
GND	Ground
TS	Control signal input/output
TT	Control signal input/output

TS-850

Pin name	Description
GND	Ground
TT	Control signal input/output
GND	Ground
NC	Unused
TS	Control signal input/output
+DC	+13.8V

Fig. 2 Control cable connection

Sensor Block

An attenuator consisting of R1 through R7 is inserted into the sensor to stabilize impedance and reduce unwanted waves during tuning. High power signals are input from the remote controller to the J1 terminal and passed through this attenuator.

The high power signal is tapped off from the main signal and passed through R11 to the frequency read block.

The forward wave and reflected wave signals of the HF signal are detected by a coupler consisting of L12, L13, R9, and R10 ; converted into a control voltage using D1 and D2 ; then sent to the analog-to digital converter.

The converted digital signal is used as an input signal for the input power check and reflection coefficient operation.

The forward and reflected waves are sent through buffers Q1 and Q2 to a DBM consisting of L16, L17, and D47 and sent to comparator IC15 (1/2) as impedance signal IZI. Impedance signal IZI is compared with a 50-ohm impedance.

Voltage and current signals are sent to a DBM consisting of L14, L15, and D46 ; compared with each other, then extracted as a phase signal.

Input power level range : 8 ~ 15W.

- **Overpower**

When power exceeding approximately 20W is detected during the power check, a 100ms counter is set. When a tuning start (TS) is canceled after 100ms or within 100ms, the through mode is entered.

1 : Power check
2 : TS check
3 : Returned to 1 if within 100ms

* If the power is proper in step 1, stop the above operation and proceed to the next operation.

CIRCUIT DESCRIPTION

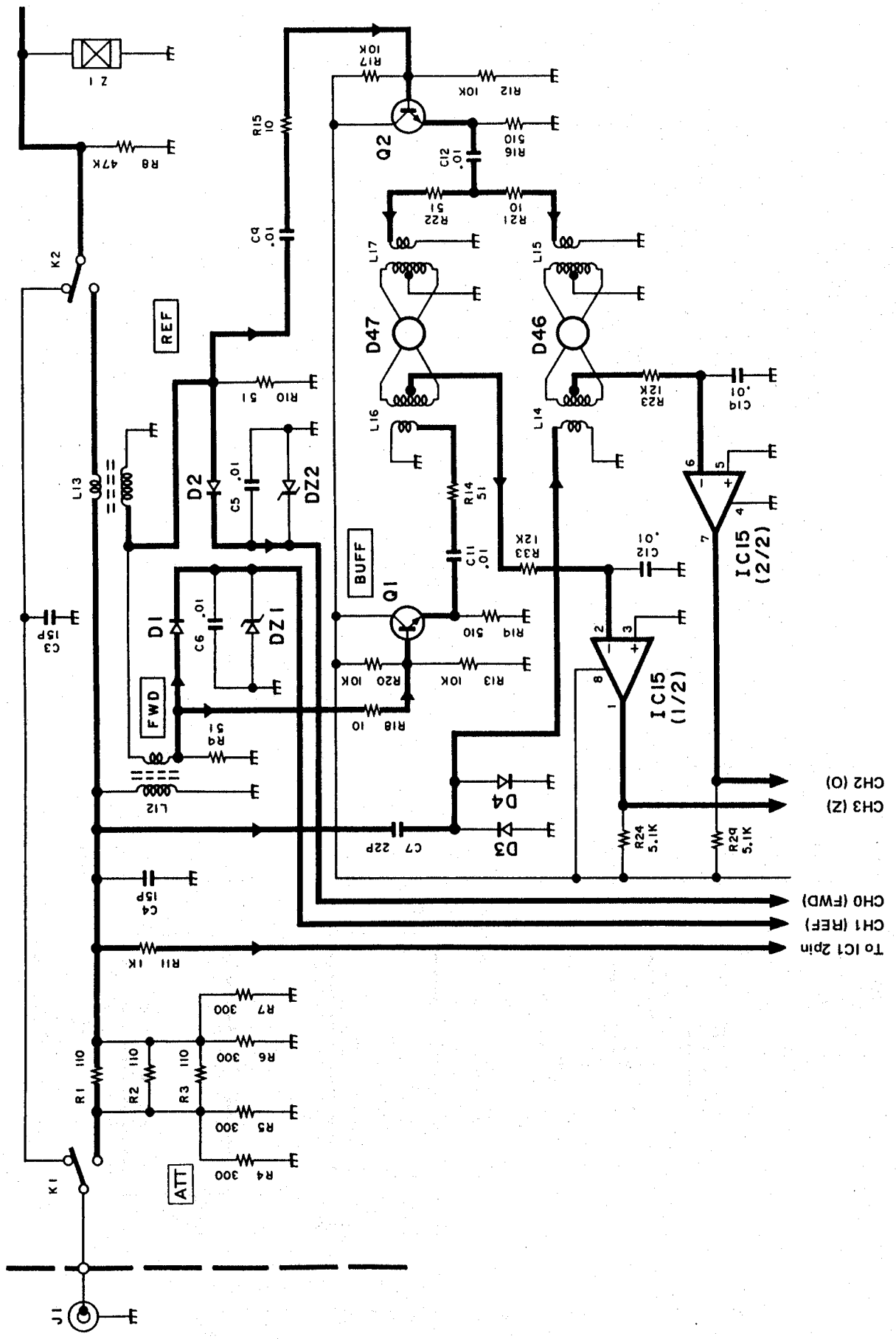


Fig. 3 Sensor circuit (Forward and reflected waves)

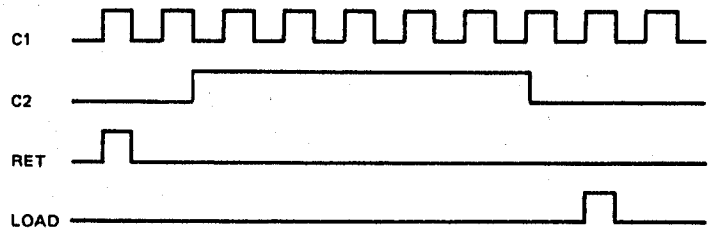
CIRCUIT DESCRIPTION

Frequency Read Block

The HF signal obtained by the sensor circuit is passed through a limiter consisting of C18, C21, D6, and D7, then sent to frequency divider IC1 (1/16) (μPB553AC). The output level of IC1 is ECL level, so it is converted to TTL level by buffer amplifier Q9, then fed to counter IC2.

The CPU controls the counter at the timing shown in the Figure 4. The counter is cleared with a reset signal, a pulse of this duration is counted with a gate signal, and the count value is latched with a load signal. Meanwhile, data is sent from terminals 1 through 4. For terminals 10^0, 10^1, 10^2, and 10^3, a digit signal to indicate the data digit is output in an internal free-running period of approximately 700Hz. IC3 is used to control the bus line output. When an OE terminal is high, data is output to the bus line.

The above operation is performed only once during tuning start.



C1 : Furequency signal
C2 : Gate signal
RET : Reset signal
LOAD : LOAD signal

Fig. 4 Counter control timing chart

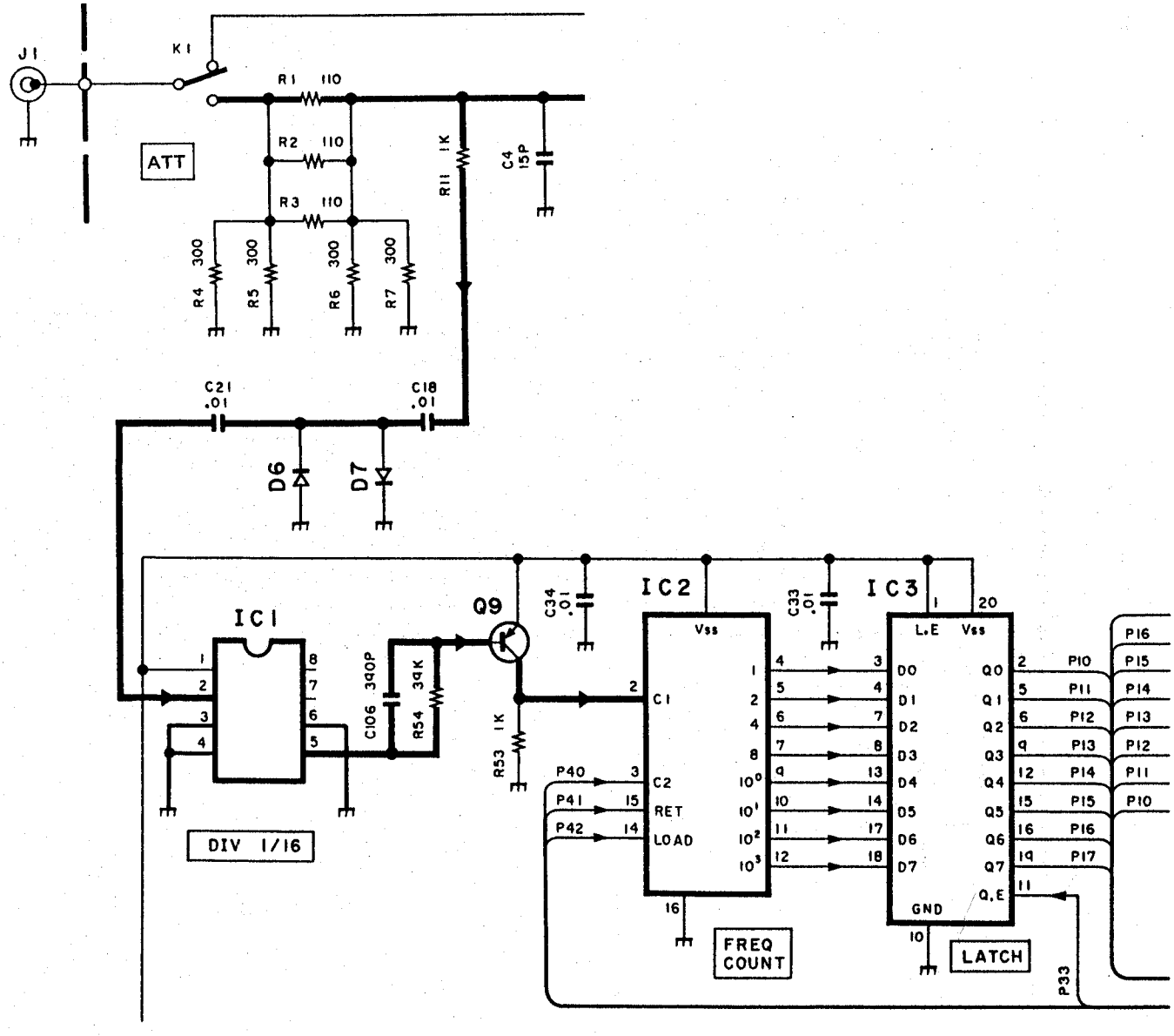


Fig. 5 Frequency read block

CIRCUIT DESCRIPTION

A/D Converter

The forward wave, reflected wave, phase, and impedance IZI voltages obtained by the sensor circuit are input to IC4. The CPU converts the signal voltage to an 8-bit digital signal and loads it, as required.

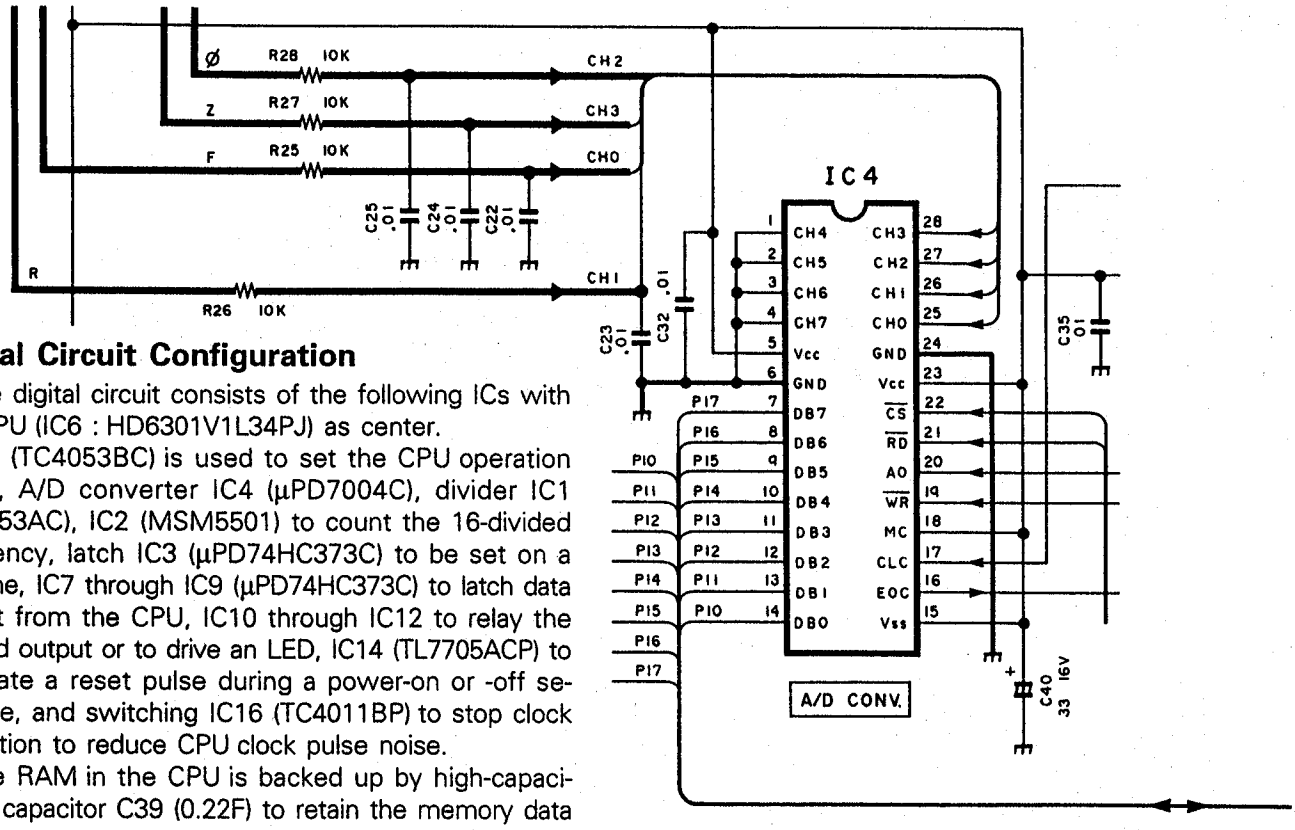


Fig. 6 A/D converter circuit

Digital Circuit Configuration

The digital circuit consists of the following ICs with the CPU (IC6 : HD6301V1L34PJ) as center.

IC5 (TC4053BC) is used to set the CPU operation mode, A/D converter IC4 (μPD7004C), divider IC1 (μPB553AC), IC2 (MSM5501) to count the 16-divided frequency, latch IC3 (μPD74HC373C) to be set on a bus line, IC7 through IC9 (μPD74HC373C) to latch data output from the CPU, IC10 through IC12 to relay the latched output or to drive an LED, IC14 (TL7705ACP) to generate a reset pulse during a power-on or -off sequence, and switching IC16 (TC4011BP) to stop clock oscillation to reduce CPU clock pulse noise.

The RAM in the CPU is backed up by high-capacitance capacitor C39 (0.22F) to retain the memory data items.

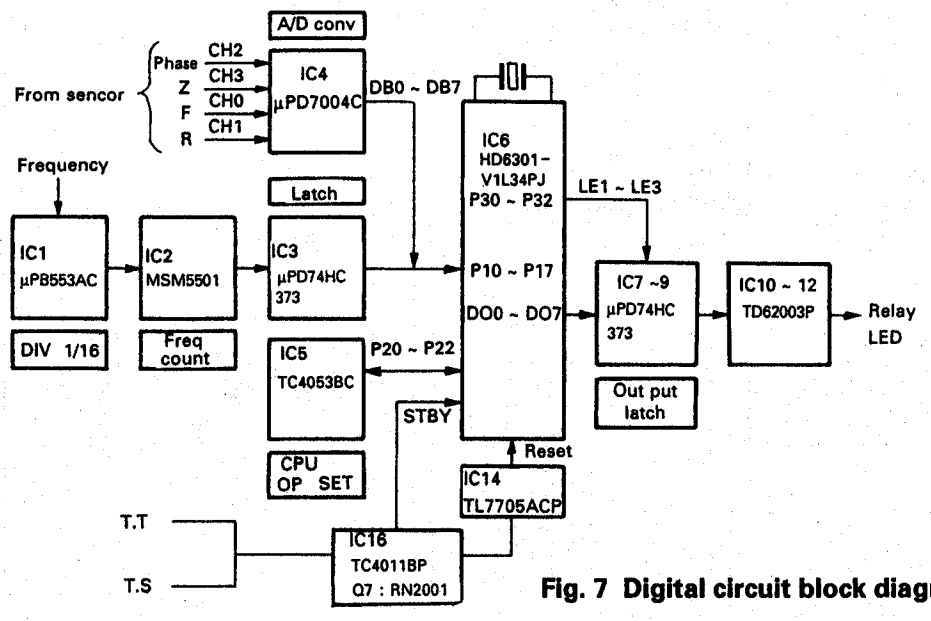


Fig. 7 Digital circuit block diagram

Output Block

Data processed by the CPU is output in 8-bit units, added to a latch pulse sequentially from IC7, then sent to IC9. A relay or LED is then driven by drivers IC10 through IC13.

When output enable circuits IC7 through IC9 are controlled, surge current is reduced during the power-on sequence.

CIRCUIT DESCRIPTION

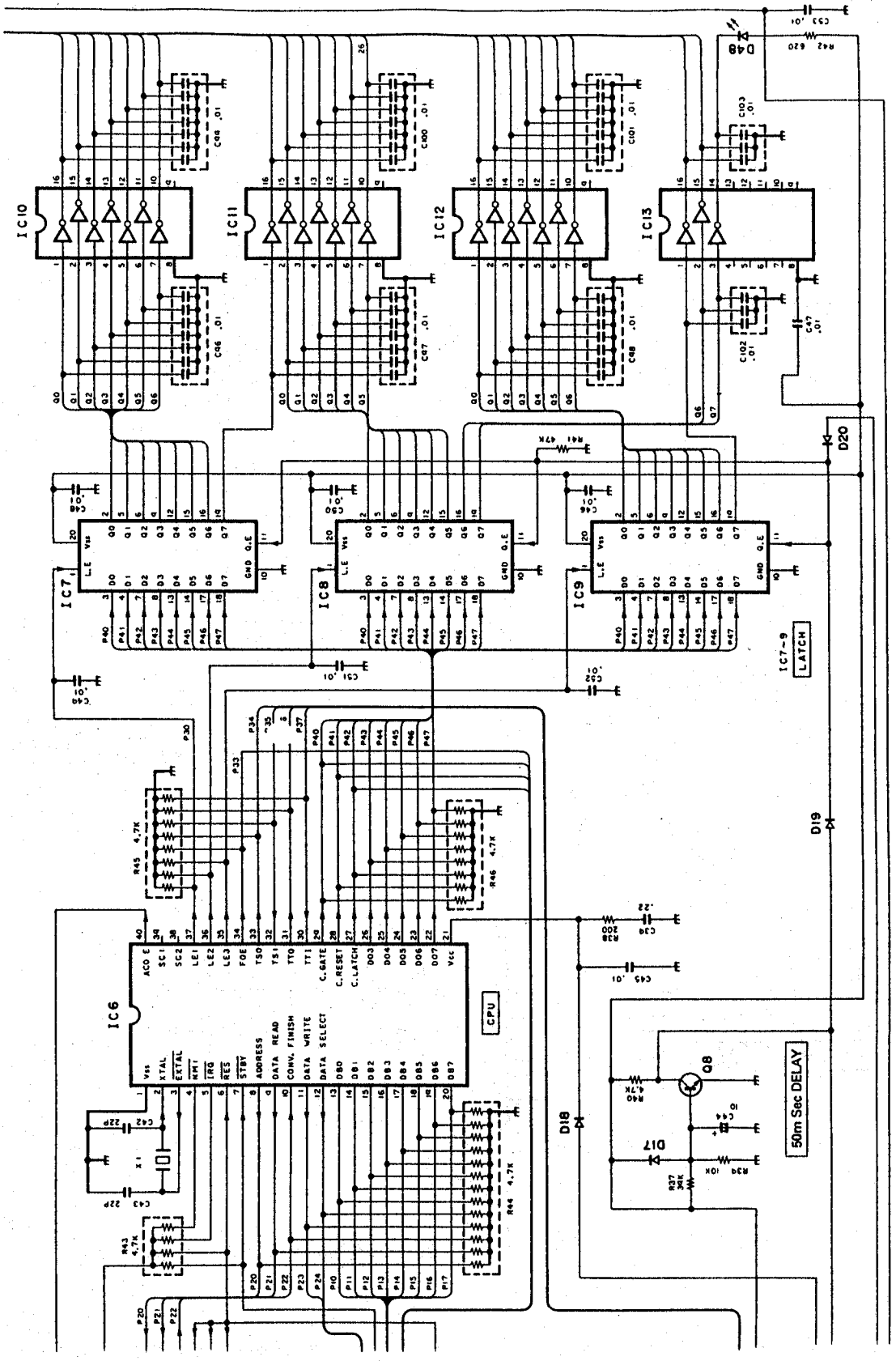


Fig. 8 Output block

CIRCUIT DESCRIPTION

Mode Setting Block

To set the CPU, terminals P20 through P22 of IC6 must be set high when activating the CPU. P20 through P22 control A/D converter IC4. Therefore, a signal is selected using IC5.

A reset signal is output from pin 5 of IC14 during mode selection. When the reset signal output is added to the A, B, and C terminals of IC5, terminals X0, Y0, and Z0 are selected. The terminal level is output to terminals X, Y, and Z and added to the P20, P21, and P22 terminals of IC6.

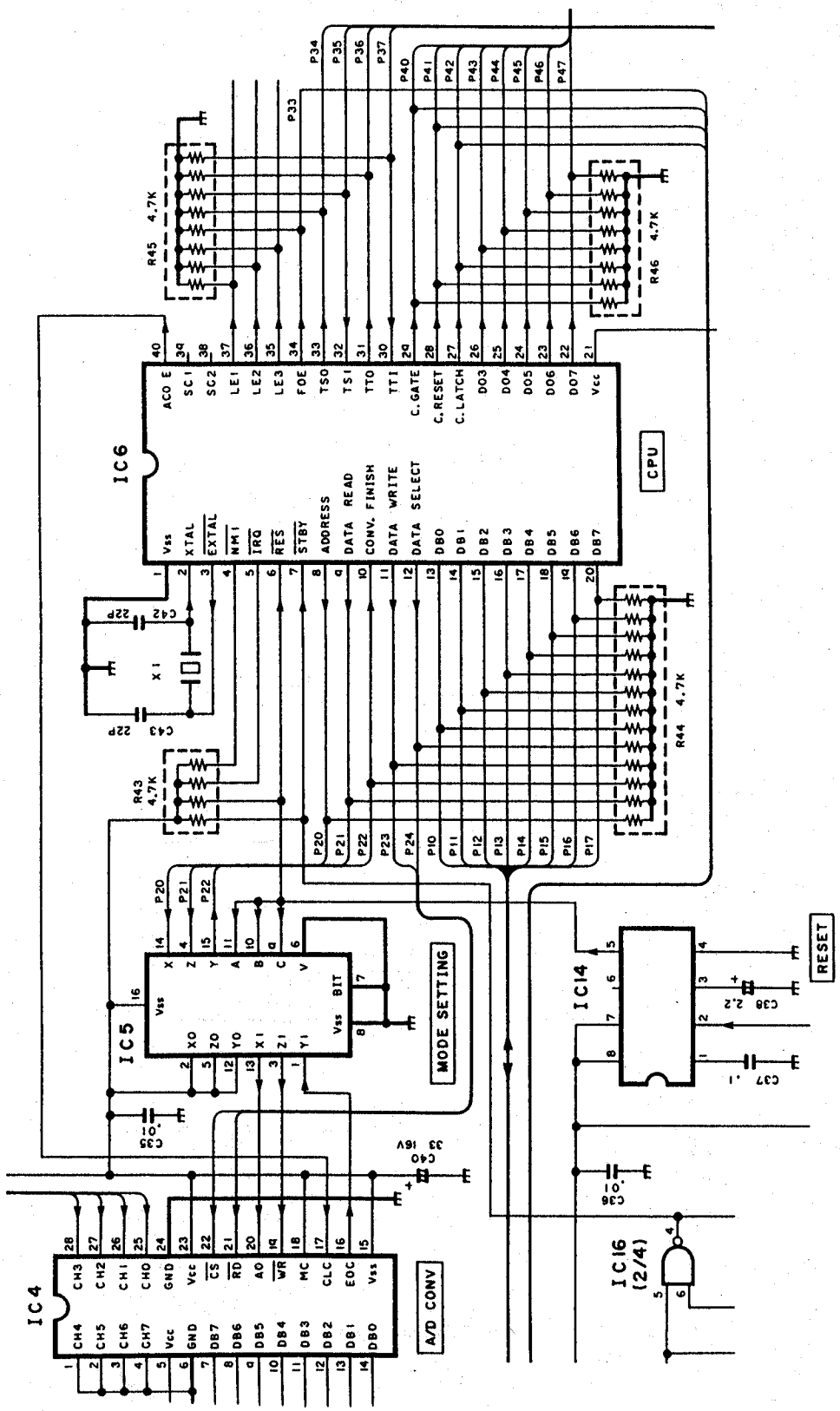


Fig. 9 Mode setting block

CIRCUIT DESCRIPTION

CPU Standby Operation and Interface

The STBY signal is low and the CPU stops the clock oscillation, then enters the standby mode. When a TS or TT signal is set low in the standby mode, the TS signal sets the STBY signal high using Q4, IC16 (3/4), and IC16 (2/4). The TT signal sets the STBY signal high using Q6, IC16 (1/4), and IC16 (2/4).

The AT-300 then exits the standby mode. When the STBY signal is set high, it is delayed by the time constant of R55 and C29, and pin 2 of IC14 is set high. When this terminal is set high, a reset signal (low) of the duration determined by C38 is output from pin 5.

When the reset signal is set high, the CPU starts operation. IC4 checks the P35 and P37 outputs, that is, the Q4 and Q6 outputs and judges whether the drive signal is a TS or TT signal. A tuning or through operation is then performed.

At this time, the CPU cannot be activated. A high signal is added to the base of Q8 via D12 during a power-on sequence, but it is delayed by the time constant determined by R37 and C44. This delay enables the STBY signal to be set high via D15 (D15, D9, and R35 are diode-ORed) using IC16 (3/4) and IC16 (2/4). This is done to initialize the CPU.

When the TS and TT signals are set high, the STBY signal is set low using Q4, Q6, IC16 (3/4), IC16 (1/4), and IC16 (2/4). The CPU thus enters the standby mode.

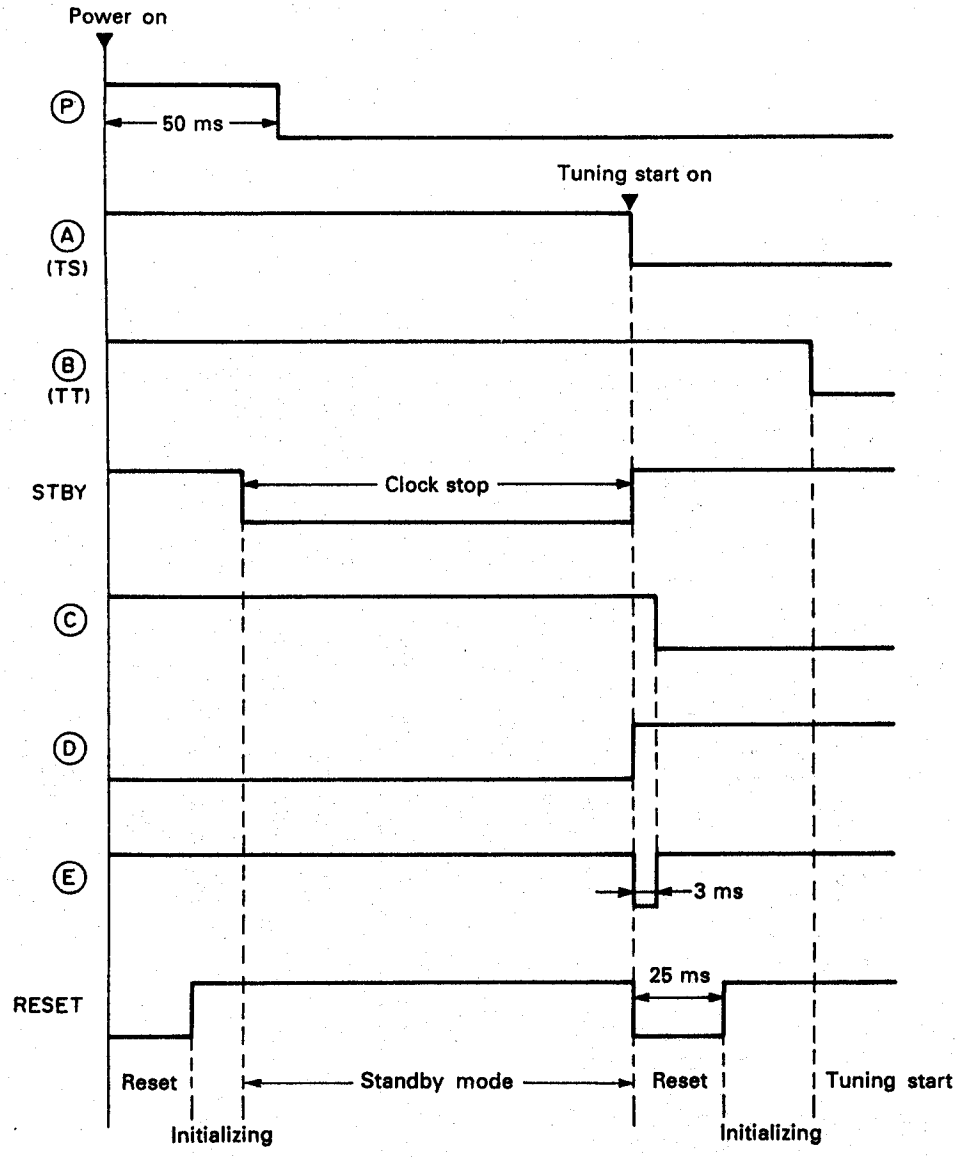


Fig. 10 Tuning start

CIRCUIT DESCRIPTION

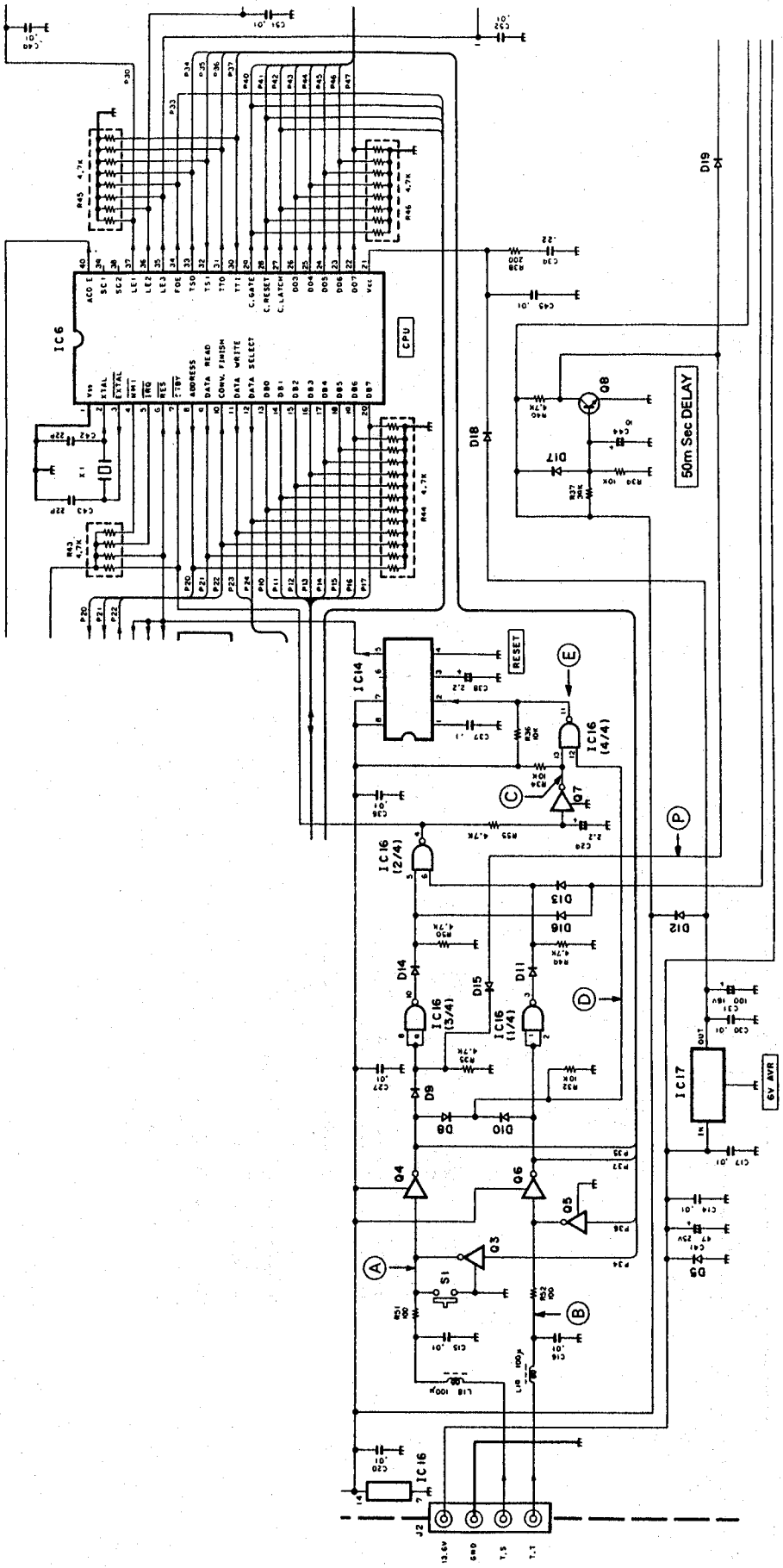


Fig. 11 Interface rest block

CIRCUIT DESCRIPTION

LC Tuning Circuit

This circuit is used for antenna tuning. It consists of coils L1 through L11 to enable a false and linear change, capacitors C76 through C92, and relays K3 through K24 to set capacitors on or off. Capacitors can be set to IN (TX) or OUT (ANT) by relays K12 and K15. These relays are driven by a signal from the CPU.

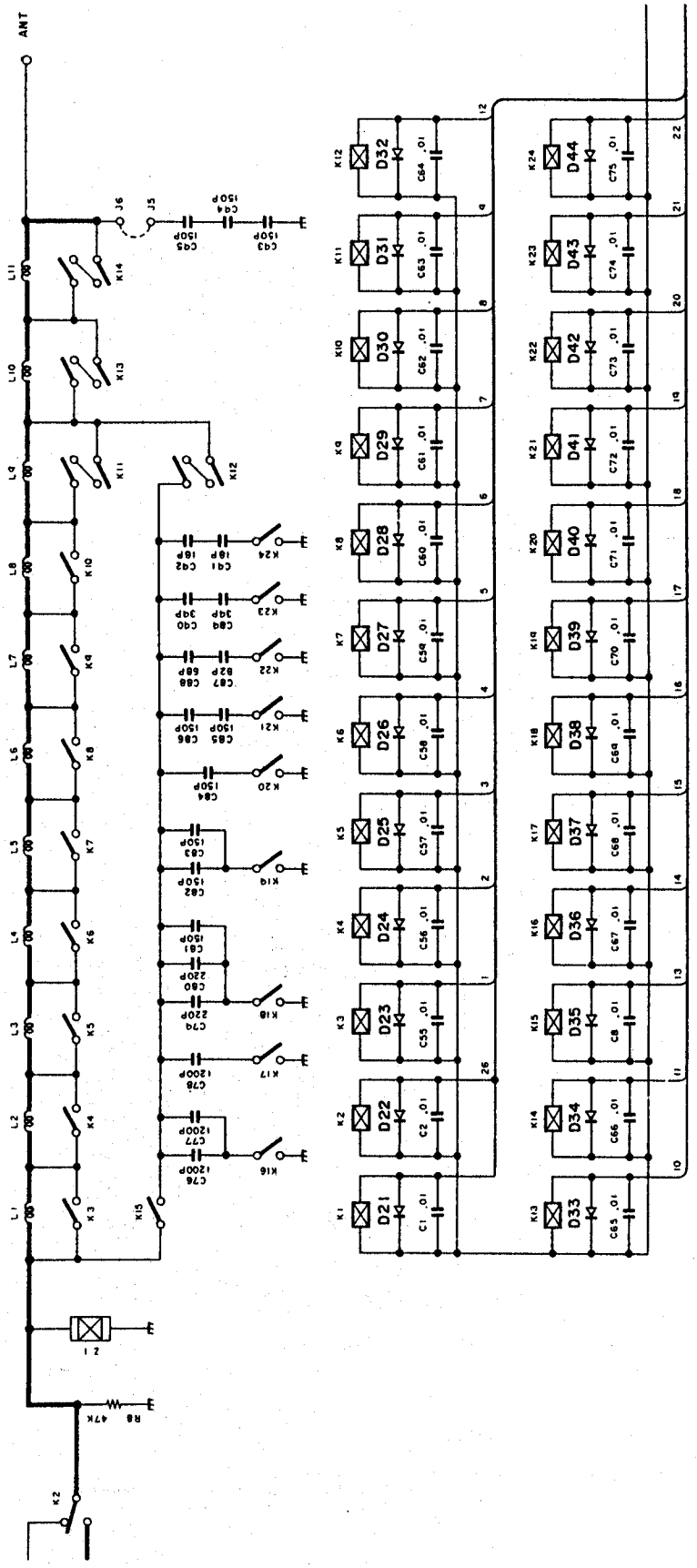


Fig. 13 LC tuning circuit

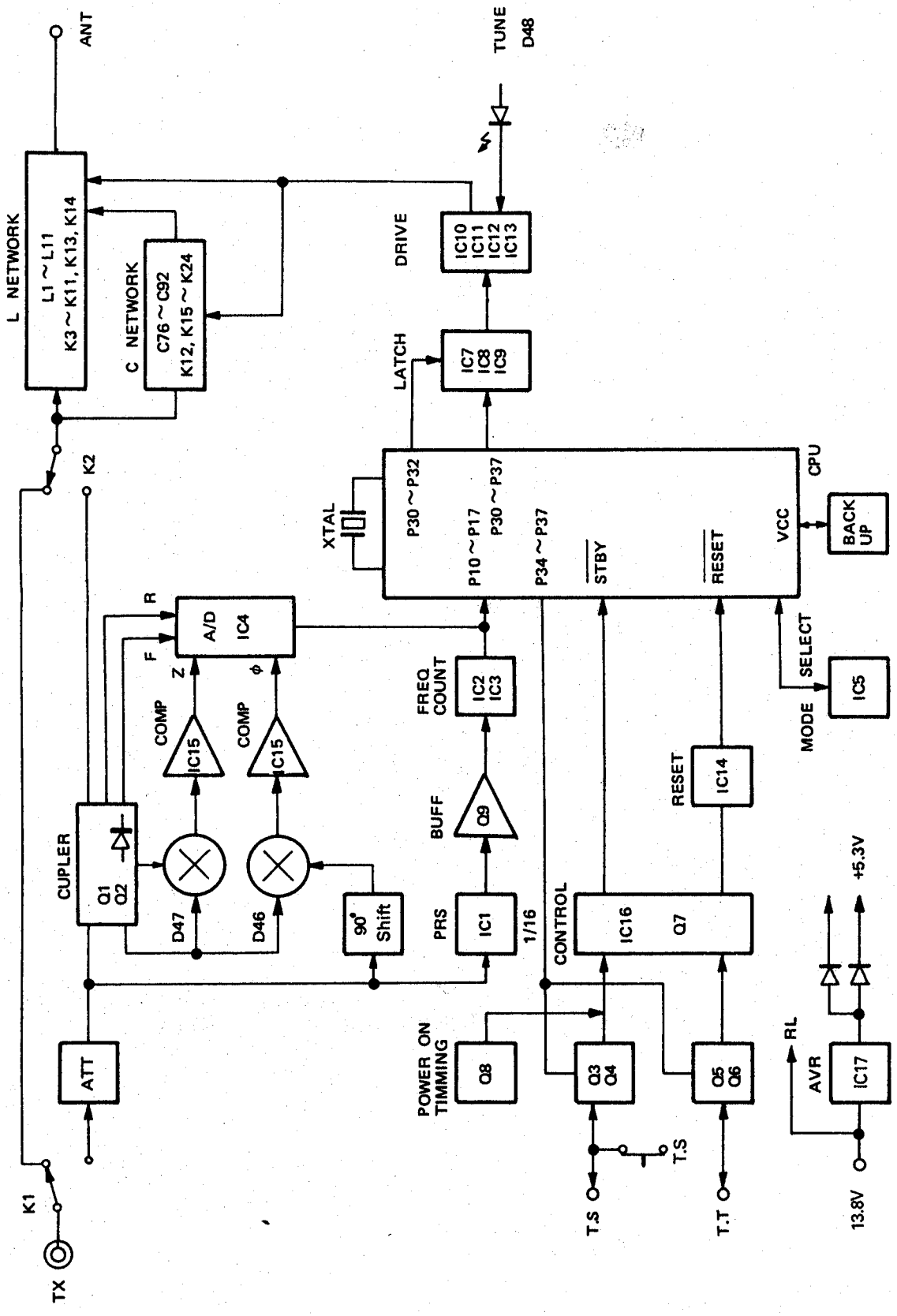
CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
Control signal	Vss	1	Vss	Ground terminal	–	
	XTAL	2	XTAL	Crystal connection terminal	I	
	XTAL	3	XTAL	Crystal connection terminal	O	
	NMI	4	–		–	
	IRQ	5	–		–	
	RES	6	$\overline{RES}$	CPU reset terminal	I	
	STBY	7	$\overline{STBY}$	CPU clock stop terminal	I	"L" : Stop
2 ports	P20	8	AO	A/D control address signal	O	
	P21	9	WR	A/D data read signal	O	
	P22	10	EOC	A/D conversion end signal	I	"L" : Conversion end
	P23	11	RD	A/D dara write signal	O	
	P24	12	CS	A/D chip select signal	O	"L" : Select
1 ports	P10	13	DB0	A/D conversion, counter data bus	I/O	
	P11	14	DB1	A/D conversion, counter data bus	I/O	
	P12	15	DB2	A/D conversion, counter data bus	I/O	
	P13	16	DB3	A/D conversion, counter data bus	I/O	
	P14	17	DB4	A/D conversion, counter data bus	I/O	
	P15	18	DB5	A/D conversion, counter data bus	I/O	
	P16	19	DB6	A/D conversion, counter data bus	I/O	
	P17	20	DB7	A/D conversion, counter data bus	I/O	
	Vcc	21	Vcc	Power terminal	–	
4 ports	P47	22	DO7	Relay output signal	O	
	P46	23	DO6	Relay output signal	O	
	P45	24	DO5	Relay output signal	O	
	P44	25	DO4	Relay output signal	O	
	P43	26	DO3	Relay output signal	O	
	P42	27	DO2/L	Relay output signal / counter latch signal	O	⎍
	P41	28	DO1/R	Relay output signal / counter reset signal	O	⎍
	P40	29	DO0/G	Relay output signal / counter gate signal	O	⎍
3 ports	P37	30	TTI	Through mode drive input	I	"H" : Drive
	P36	31	TTO	Through mode response output	O	"H" : Response
	P35	32	TSI	Tune mode drive input	I	"H" : Drive
	P34	33	TSO	Tune mode response output	O	"H" : Response
	P33	34	FOE	Frequency read circuit's separated signal	O	"H" : Separation
	P32	35	LE3	Output latch pulse 3	O	⎍
	P31	36	LE2	Output latch pulse 2	O	⎍
	P30	37	LE1	Output latch pulse 1	O	⎍
	SC2	38	–		–	
	SC1	39	–		–	
	E	40	ACO	A/D clock output terminal	O	1/4 of clock

Table 1 CPU : HD6301V1L34PJ (IC6) terminal function

AT-300

BLOCK DIAGRAM



DESCRIPTION OF COMPONENTS

ANT TUNER UNIT (W02-1684-08)

Ref. No.	Use/Function	Operation/Condition/Compatibility
IC1	1/16 divider	
IC2	1/16 divider counter	BCD code.
IC3	Latch	High impedance level without frequency read.
IC4	A/D converter	CH0 : FWD voltage, CH1 : REF voltage, CH2 : Phase voltage, CH3 : Impedance voltage.
IC5	CPU mode setting	CPU P20, 21, 22 : High
IC6	CPU	Single chip mode operation.
IC7~9	Output latch	Auto mode O,E : Low.
IC10~13	Output driver	
IC14	Reset making	25ms.
IC15	Comparator	Phase is "+" : High, "–" : Low. IZI is 50Ω > High, 50Ω < Low.
IC16	Switching	STBY, RESET TRIG occur.
IC17	AVR	6V, 1A.
Q1,2	Buffer	Q1 : REF wave, Q2 : FWD wave.
Q3	Switching	"H" level when through mode response.
Q4	Switching	Turn to low when tune mode.
Q5	Switching	"H" level when tune mode.
Q6	Switching	Turn to low when through mode.
Q7	Switching	RESET TRIG occur.
Q8	Switching	"H" 50ms when power switch is turned ON.
Q9	Buffer	ELC level → TTL level.

AT-300

PARTS LIST

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
AT-300						
1	1A		A01-2001-08	CABINET(TOP)		
2	3B		A01-2002-08	CABINET(BOTTOM)		
			B42-3397-08	LABEL(KENWOOD)		
		*	B42-3448-08	LABEL		
			B46-0420-00	WARRANTY CARD	K	
		*	B62-0072-08	INSTRUCTION MANUAL		
		*	B72-0134-08	LABEL(AT-300)		
C1 ,2			CK45B1H103K	CERAMIC 0.010UF K		
C3 ,4			CM93CC2H150J	MICA 15PF J		
C5 ,6			CK45B1H103K	CERAMIC 0.010UF K		
C7			CC45SL2H220J	CERAMIC 22PF J		
C8 -25			CK45B1H103K	CERAMIC 0.010UF K		
C27 ,28			CK45B1H103K	CERAMIC 0.010UF K		
C29			CS15E1C2R2M	TANTAL 2.2UF 16WV		
C30			CK45B1H103K	CERAMIC 0.010UF K		
C31			CE04EW1C101M	ELECTRO 100UF 16WV		
C32 -36			CK45B1H103K	CERAMIC 0.010UF K		
C37			CK45F1H104Z	CERAMIC 0.1UF Z		
C38			CS15E1C2R2M	TANTAL 2.2UF 16WV		
C39			C90-2127-08	ELECTRO 0.22F		
C40			CE04EW1C330M	ELECTRO 33UF 16WV		
C41			CE04EW1E470M	ELECTRO 47UF 25WV		
C42 ,43			CC45SL2H220J	CERAMIC 22PF J		
C44			CS15E1A100M	TANTAL 10UF 10WV		
C45 -53			CK45B1H103K	CERAMIC 0.010UF K		
C55 -75			CK45B1H103K	CERAMIC 0.010UF K		
C76 -78			CM93D2H122J	MICA 1200PF J		
C79 ,80			C91-1112-08	MICA 220PF J		
C81 -86			C91-1111-08	MICA 150PF J		
C87			C91-1110-08	MICA 82PF J		
C88			C91-1109-08	MICA 68PF J		
C89 ,90			C91-1108-08	MICA 39PF J		
C91 -92			C91-1107-08	MICA 18PF J		
C93 -95			C91-1111-08	MICA 150PF J		
C96 -101			R90-0715-08	MULTI-CO 0.01X7		
C102,103			R90-0716-08	MULTI-CO 0.01X3		
C104			CK45B1H103K	CERAMIC 0.010UF K		
C106			CK45B2H391K	CERAMIC 390PF K		
			E09-0672-08	6P CONNECTOR(ACSY)		
			E23-0644-08	TERMINAL		
			E23-0645-08	TERMINAL		
			E23-0646-08	PIN CONNECTOR		
10	3A,3B		E23-0647-08	HOLD LUG		
11	2A,3B		E23-0652-08	TERMINAL		
		*	E30-3037-08	CONTROL CABLE(15M ACSY)		
			E31-6142-08	CABLE ASSY(J5-J6)		
			E31-6143-08	WIRE(RF-IF)		
			E31-6144-08	WIRE(ANT)		
			E31-6145-08	WIRE(GND)		
			E31-6150-08	CABLE ASSY(J9-J10)		
J1	1A		E04-0167-05	ANT. RECEPTACLE		
J5 ,6			E23-0648-05	TERMINAL		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
			F09-0427-08	INSULATING COVER(ACSY)		
			F10-1432-08	ATT SHIELD CASE		
			F10-1433-08	CPU SHIELD CASE		
			F10-1434-08	CPU SHIELD PLATE		
			F10-1435-08	LATCH SHIELD PLATE		
			F10-1436-08	SHIELD CASE(BOTTOM)		
			F10-1437-08	SHIELD PLATE		
15	3B		F29-0441-08	STAYER TIGHT BUSHING		
16	2B		G53-0588-08	PACKING		
17	3B		G53-0589-08	PACKING		
18	3A,3B		G53-0590-08	PACKING		
			G53-0592-08	RUBBER SLEEVE(ACSY)		
		*	G53-0597-08	RUBBER SLEEVE(ACSY)		
			H02-0606-08	ACSY CASE		
			H25-0029-04	PROTECTION BAG(ACSY)		
			H25-0103-04	PROTECTION BAG(ACSY)		
			H25-0106-04	PROTECTION BAG(INSTRUCTION M.)		
			H25-0736-08	PROTECTION BAG(RADIO)		
		*	H52-0147-08	ITEM CARTON		
		*	H62-0130-08	OUTER CARTON		
			J21-4300-08	MOUNTING BLACKET(ACSY)		
20	1A		J21-4301-08	CONNECTOR MOUNT HARDWARE		
21	3A,3B		J21-4302-08	MOUNTING HARDWARE		
23	1A,2A		J42-0469-08	CABLE CONNECTOR		
L1			L34-1293-08	COIL		
L2			L34-1294-08	COIL		
L3			L34-1295-08	COIL		
L4			L34-1296-08	COIL		
L5			L34-1297-08	COIL		
L6			L34-1298-08	COIL		
L7			L34-1299-08	COIL		
L8			L34-1300-08	COIL		
L9			L34-1301-08	COIL		
L10			L34-1302-08	COIL		
L11			L34-1303-08	COIL		
L12 ,13			L39-0486-08	DETECTION COIL		
L14 -17			L39-0488-08	DETECTION COIL		
L18 -20			L33-0736-08	FERRI INDUCTOR		
L21			L39-0487-08	DETECTION COIL		
X1			L77-1428-08	XTAL RESONATOR 4.0MHZ		
			N09-2095-08	U. BOLT(ACSY)		
			N09-2096-08	HEX. BOLT(ACSY)		
			N10-2030-41	NUT(M3) AVR IC		
25	2A,3B		N14-0546-08	NUT		
26	2A,3B		N14-0547-08	WING NUT		
27	3A,3B		N14-0548-08	NUT(M4) COVER		
			N15-1030-41	FLAT WASHER		
29	2A,3B		N15-1050-60	FLAT WASHER		
			N16-0030-41	SPRING WASHER		
31	2A,3B		N16-0050-60	SPRING WASHER		
			N30-2604-46	BINDING SCREW(M2.6X6) CPU		
			N99-0344-08	SCREW SET		
A	3B		N09-2097-08	HEX. BOLT(ANT)		

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B	2B,3A		N09-2099-08	HEX. BOLT (M5X25)GND TERMINAL		
C	2A,3B		N09-2100-08	SCREW(M5X10)MOUNTING HARD WARE		
D	2A,3B		N09-2101-08	SELF TAPPING SCREW		
E	1A,1B		N09-2102-08	MACHINE SCREW(M4X16) COVER		
F	2A		N30-3006-46	BINDING SCREW(M3X6) AVR IC		
G	2A,2B		N87-3008-46	SELF TAPPING SCREW(3X8)PC B.		
R1 -3		*	RS14GB3D680J	FL-PROOF RS 68 J 2W		
R4 -7			RS14GB3D471J	FL-PROOF RS 470 J 2W		
R8			RD14BB2E473J	RD 47K J 1/4W		
R9 ,10			RD14BB2E510J	RD 51 J 1/4W		
R11			RD14BB2E102J	RD 1.0K J 1/4W		
R12 ,13			RD14CB2E103J	RD 10K J 1/4W		
R14			RD14CB2E510J	RD 51 J 1/4W		
R15			RD14CB2E100J	RD 10 J 1/4W		
R16			RD14CB2E511J	RD 510 J 1/4W		
R17			RD14CB2E103J	RD 10K J 1/4W		
R18			RD14CB2E100J	RD 10 J 1/4W		
R19			RD14CB2E511J	RD 510 J 1/4W		
R20			RD14CB2E103J	RD 10K J 1/4W		
R21			RD14CB2E100J	RD 10 J 1/4W		
R22			RD14CB2E510J	RD 51 J 1/4W		
R23			RD14CB2E123J	RD 12K J 1/4W		
R24			RD14CB2E512J	RD 5.1K J 1/4W		
R25 -28			RD14CB2E103J	RD 10K J 1/4W		
R29			RD14CB2E512J	RD 5.1K J 1/4W		
R32			RD14CB2E103J	RD 10K J 1/4W		
R33			RD14CB2E123J	RD 12K J 1/4W		
R34			RD14CB2E103J	RD 10K J 1/4W		
R35			RD14CB2E473J	RD 47K J 1/4W		
R36			RD14CB2E103J	RD 10K J 1/4W		
R37			RD14CB2E393J	RD 39K J 1/4W		
R38			RD14BB2E201J	RD 200 J 1/4W		
R39			RD14CB2E103J	RD 10K J 1/4W		
R40			RD14BB2E472J	RD 4.7K J 1/4W		
R41			RD14BB2E473J	RD 47K J 1/4W		
R41			RD14BB2E473J	RD 47K J 1/4W		
R42			RD14CB2E621J	RD 620 J 1/4W		
R43			R90-0286-05	MULTI-COMP 4.7KX4		
R44			R90-0452-05	MULTI-COMP 4.7KX12 J 1/4W		
R45 ,46			R90-0455-05	MULTI-COMP 4.7KX8 J 1/4W		
R47			RD14CB2E433J	RD 43K J 1/4W		
R48			RS14GB3D510J	FL-PROOF RS 51 J 2W		
R49 ,50			RD14CB2E472J	RD 4.7K J 1/4W		
R51 ,52			RD14CB2E101J	RD 100 J 1/4W		
R53			RD14CB2E102J	RD 1.0K J 1/4W		
R54			RD14CB2E393J	RD 39K J 1/4W		
R55			RD14CB2E472J	RD 4.7K J 1/4W		
R56 ,56			RD14CB2E683J	RD 68K J 1/4W		
K1 ,2			S51-1446-08	RELAY		
K3 -10			S51-1445-08	RELAY		
K11 -14			S51-2424-08	RELAY		
K15 -24			S51-1445-08	RELAY		
S1			S50-1426-08	SWITCH		

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D1 ,2			2-1K261(イ)	DIODE		
D3 ,4			1S1588	DIODE		
D5			U05B	DIODE		
D6 -11			1S1588	DIODE		
D12			10D1	DIODE		
D13 -20			1S1588	DIODE		
D21 -44			1S1588	DIODE		
D46 ,47			ND487C2-3R	DIODE(DBM)		
D48		*	B30-0880-05	LED GL3PR1		
DZ1			05AZ3X	ZENER DIODE		
DZ2			05AZ3X	ZENER DIODE		
IC1			UPB553AC	IC(PRE SCALER)		
IC2		*	MSM5501	IC		
IC3			UPD74HC373C	IC		
IC4			UPD7004C	IC(IC)		
IC5			TC4053BP	IC(3-INPUT 2CH MPX/DE-MPX)		
IC5			UPD4053BC	IC(3-INPUT 2CH MPX/DE-MPX)		
IC6		*	HD6301V1L34PJ	IC		
IC7 -9			UPD74HC373C	IC		
IC10 -13			TD62003P	IC(IC)		
IC10 -13		*	UA62003	IC(IC)		
IC15			LM2903P	IC		
IC15			NJM2903D	IC(DUAL COMPARATOR)		
IC16			TC4011BP	IC(NAND X4)		
IC16			UPD4011BC	IC(NAND X4)		
IC17			TA78006AP	IC(IC)		
Q1 ,2		*	2SC2408	TRANSISTOR		
Q3			DTC143ES	TRANSISTOR		
Q3			RN1001	TRANSISTOR		
Q4			DTA143ES	TRANSISTOR		
Q4			RN2001	TRANSISTOR		
Q5			DTC143ES	TRANSISTOR		
Q5			RN1001	TRANSISTOR		
Q6			DTA143ES	TRANSISTOR		
Q6			RN2001	TRANSISTOR		
Q7			DTC143ES	TRANSISTOR		
Q7			RN1001	TRANSISTOR		
Q8			2SC945A	TRANSISTOR		
Q9			2SA733A(P)	TRANSISTOR		
Z1			DSA-301LA	SURGE ABSORBOR		
		*	W01-0416-08	NEON LAMP(ACSY)		
35	2A	*	W02-1684-08	ANT TUNER UNIT		

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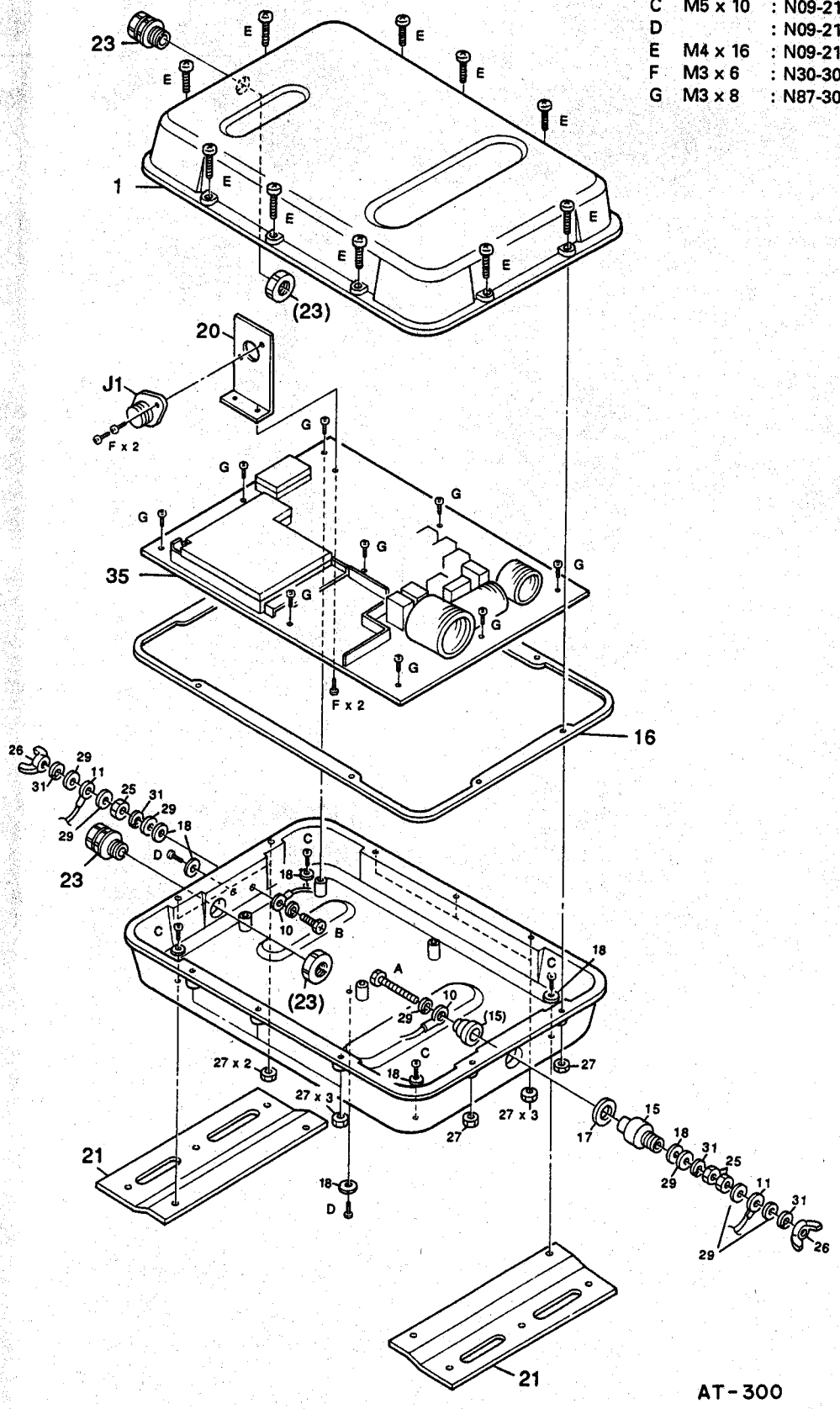
AT-300

EXPLODED VIEW

A		: N09-2097-08
B	M5 x 25	: N09-2099-08
C	M5 x 10	: N09-2100-08
D		: N09-2101-08
E	M4 x 16	: N09-2102-08
F	M3 x 6	: N30-3006-46
G	M3 x 8	: N87-3008-46



AT-300

IC1	: μPB553AC
IC2	: MSM5501
IC3,7~9	: μPD74HC373C
IC4	: μPD7004C
IC5	: TC4053BP
IC6	: HD6301V1L34PJ
IC10~13	: TD62003P
IC14	: TL7705ACP
IC15	: NJM2903D
IC16	: TC4011BP
IC17	: NJM7806AP
Q1,2	: 2SC2408
Q3,5,7	: RN1001
Q4,6	: RN2001
Q8	: 2SC945
Q9	: 2SA733
D1,2	: 2-1K261(f)
D3,4,6~11,13~44	: 1S1588
D5	: U05B
D12	: 10D1
D46,47	: ND487C2-3R
D48	: B30-0880-05
DZ1,2	: 05AZ3X

AT-300 PC BOARD

ANT TUNER UNIT (W02-1684-08) Component side view